In the negative—
San Domingo.

Abstaining from voting—
Brazil, France.

Ayes, 22; noes, 1; abstaining, 2.

III. "*Resolved*, That from this meridian longitude shall be counted in two directions up to 180 degrees, east longitude being plus and west longitude minus."

This resolution was adopted by the following vote:—

In the affirmative—

Chili,	Liberia,
Colombia,	Mexico,
Costa Rica,	Paraguay,
Great Britain,	Russia,
Guatemala,	Salvador,
Hawaii,	United States,
Japan,	Venezuela.

In the negative—

Italy,	Sweden,
Netherlands,	Switzerland.
Spain,	

Abstaining from voting

Austria-Hungary,	Germany,
Brazil,	San Domingo,
France,	Turkey.

Ayes, 14; noes, 5; abstaining, 6.

IV. "*Resolved*, That the Conference proposes the adoption of a universal day for all purposes for which it may be found convenient, and which shall not interfere with the use of local or other standard time where desirable."

This resolution was adopted by the following vote:—

In the affirmative—

Austria-Hungary,	Mexico,
Brazil,	Netherlands,
Chili,	Paraguay,
Colombia,	Russia,
Costa Rica,	Salvador,
France,	Spain,
Great Britain,	Sweden,
Guatemala,	Switzerland,
Hawaii,	Turkey,
Italy,	United States,
Japan,	Venezuela.
Liberia,	

Abstaining from voting—
Germany, San Domingo.

Ayes, 23; abstaining, 2.

V. "*Resolved*, That this universal day is to be a mean solar day; is to begin for all the world at the moment of mean midnight of the initial meridian, coinciding with the beginning of the civil day and date of that meridian, and is to be counted from zero up to twenty-four hours."'

This resolution was adopted by the following vote:—

In the affirmative—

Brazil,	Liberia,
Chili,	Mexico,
Colombia,	Paraguay,
Costa Rica,	Russia,
Great Britain,	Turkey,
Guatemala,	United States,
Hawaii,	Venezuela.
Japan,	

In the negative—
Austria-Hungary, Spain.

Abstaining from voting—

France,	San Domingo,
Germany,	Sweden,
Italy,	Switzerland.
Netherlands,	

Ayes, 15; noes, 2; abstaining, 7.

VI. "*Resolved*, That the Conference expresses the hope that as soon as may be practicable the astronomical and nautical days will be arranged everywhere to begin at mean midnight."

This resolution was carried without division.

VII. "*Resolved*, That the Conference expresses the hope that the technical studies designed to regulate and extend the application of the decimal system to the division of angular space and of time shall be resumed, so as to permit the extension of this application to all cases in which it presents real advantages."

The motion was adopted by the following vote:—

In the affirmative—

Austria-Hungary,	Mexico,
Brazil,	Netherlands,
Chili,	Paraguay,
Colombia,	Russia,
Costa Rica,	San Domingo,
France,	Spain,
Great Britain,	Switzerland,
Hawaii,	Turkey,
Italy,	United States,
Japan,	Venezuela.
Liberia,	

Abstaining from voting—
Germany, Sweden.
Guatemala,

Ayes, 21; abstaining, 3.

Done at Washington, October 22, 1884.

C. R. P. RODGERS, Rear-Admiral U.S.N., *President*,
L. CRULS (Brazil), JANSSEN (France), } *Secretaries*.
R. STRACHEY (Great Britain) . . . }

"*Resolved*, That a copy of the resolutions passed by this Conference shall be communicated to the Government of the United States of America, at whose instance and within whose territory the Conference has been convened."

ON THE INTERFERENCE-CURVES KNOWN AS "OHM'S FRINGES"

PERHAPS I may be allowed to recall the attention of physicists to the above "strange and interesting phenomena," as they are rightly called by their discoverer, Prof. G. S. Ohm (see *Pogg. Annalen* for 1853, vol. xc. p. 327); partly for the purpose of indicating a simple method of observing them.

According to Prof. Ohm's directions two plates of equal thickness are to be cut from a uniaxial crystal, with parallel surfaces making an angle of 45° with the optic axis. One of these plates is to be placed on the other in such a position that the optic axes lie in the same plane but on opposite sides of the normal common to the two plates, with which they make, of course, equal angles of 45°. When this combination is held in a convergent beam of plane-polarised monochromatic light (*e.g.* yellow sodium light), numerous alternations of bright and dark elliptical bands are seen, most distinctly when the plane containing the optic axes makes an angle of 45° with the plane of polarisation of the light.

Of course a pair of "Savart's band" plates, when properly oriented, will answer for the above experiment; but the peculiar double refraction of quartz causes more complicated but beautiful results.

Now, since in Iceland spar the optic axis makes an angle of very nearly 45° (strictly, 44° 36′) with the natural faces of the rhombohedron, all that is required is to obtain an even cleavage-plate of the spar, about 2 cm. × 1 cm. and about 2 mm. thick, to break it in half, to turn one of the pieces round in a plane parallel to its surfaces through an angle of 180° from its position when broken off, and to cement it on the other piece in this position with Canada balsam or dammar.

Then, on placing the combination in a polariscope (for instance, laying it on the eye-lens of a microscope with analyser just above it) the series of ellipses will be well seen. Sodium light, *e.g.* that from a Bunsen burner with a bead of sodium carbonate held in the flame, must be used.

Prof. Ohm refers to a paper by Langberg (which I have not been able to get a sight of) in which the occurrence and form of these bands were predicted from theory; so that the case resembles those of Airy's spirals and Hamilton's conical refraction.

A pair of plates with surfaces making an angle of 70° (or more) with the optic axis also show these ellipses; and perhaps more instructively, since with such plates it is easy to trace the origin of the bands in the coalescence of portions of the circular isochromatic bands of high order which surround the optic axis in each plate.

Those who have a pair of Savart's plates mounted so that one can rotate over the other, will find it most interesting and instructive to watch (in monochromatic light) the changes in form and character of the interference-bands as the azimuth of one of the plates is gradually altered.

Eton College H. G. MADAN

CONTINUOUS AUTOMATIC BRAKES

THE returns of the Railway Department of the Board of Trade serve as an excellent index to the defects in the management and working of the railway system in this country, the defects being brought to light during the investigations of the trivial casualties and disastrous accidents which take place, and inquired into by the experienced inspectors of the Board of Trade.

It is evident that by far the greater number of accidents seem to have been caused by the trains not being fitted with a really good brake, and in consequence being unable to stop quickly in cases of emergency. Some even have been caused by the brake itself failing to "go on" when required, caused either by some defect in the brake mechanism, or the design of the brake itself has been bad, giving the engine-driver a false sense of security, and leading the train with its living load into unnecessary danger.

It is a pity the railway companies do not pay more attention to the conditions laid down by the Board of Trade with regard to continuous brakes, stating the qualities the brake ought to possess, for it is evident the Board does not wish the adoption of any particular patentee's brake, but a brake which includes to the fullest extent the conditions laid down. It so happens that the Westinghouse automatic brake answers the conditions better than any other, and therefore the Board is anxious to see it in general use, not because an ex-inspector of the Board happens to be the chairman of the English Westinghouse Brake Company, as the secretary of one English railway seems to imagine, but because it is the best brake.

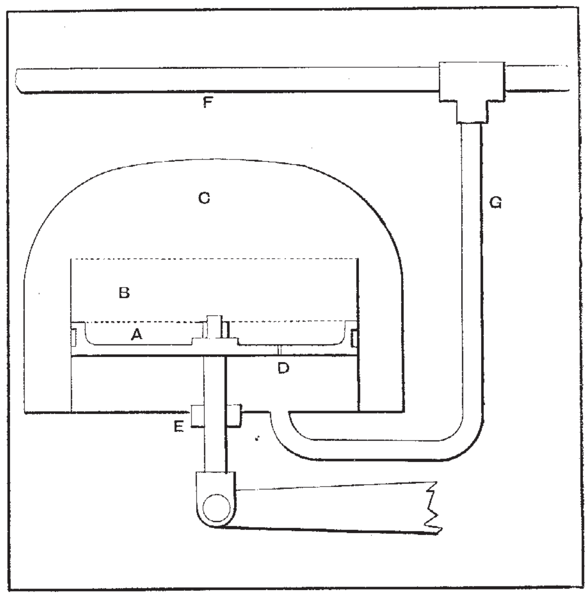
In an extract from the Board of Trade returns on continuous brakes for the half year ending June 30, published by the Vacuum Brake Company, we find the Westinghouse automatic credited with 397 faults for a mileage of 15,506,447.

We think it may be truly stated that the Westinghouse automatic has not had fair play with some of the companies having it partially in use, its failures having been carefully reported, while any failure of their own special brake, not having any serious consequences, has been looked over.

Take for instance the returns sent in by the Midland Company. Here the Westinghouse automatic has failed thirty-seven times for a mileage of 374,390, or one fault for every 10,118 miles, while the Midland automatic vacuum has six failures reported for a mileage of 5,245,573, or one fault for every 874,262 miles run. On the other hand we have the London, Brighton, and South Coast Railway using the Westinghouse automatic on the whole of their trains; they report seventy-four failures for a mileage of 3,122,510, or one fault for every 42,196 miles run.

Why should the Westinghouse automatic run four times as many miles per failure on the Brighton line than on the Midland? The reason is not far to seek; on the Brighton line the Westinghouse automatic is properly looked after, and kept in good repair, while on the Midland it has to stand back and give place to the vacuum automatic, the Company's brake.

The automatic vacuum brake in use on the Midland Railway has, as its name implies, the pressure of the atmosphere opposed to a partial vacuum for its motive



power, the vacuum being created by means of an ejector on the engine, connected to every vehicle on the train by means of a continuous pipe, having flexible pipes and couplings between the vehicles. To maintain the vacuum throughout the train against leakage, there is a small ejector continually in use on the engine.

Coupled to the continuous pipe on each vehicle is the automatic brake cylinder and reservoir peculiar to the Midland automatic brake, the piston being connected by means of levers and rods to the brake-blocks. The illustration gives a good idea of the general construction of the brake-cylinder and its connections, the arrangement being as follows:—The brake-cylinder B is placed inside the reservoir C, the piston A working air-tight in the cylinder; the piston-rod passing through the bottom of the cylinder by means of a gland, E, having a flexible packing ring, so arranged that when the piston is at the bottom of the cylinder it comes in contact with the packing ring, making an air-tight joint; but when the piston moves upwards, leaving the packing ring, air is able to pass through the gland into the lower part of the brake-cylinder. The continuous pipe F is connected by the branch pipe G to the lower part of the brake-cylinder.